PSLV - C14 /OCEANSAT-2 MISSION

Indian Space Research Organisation

PSLV MISSIONS IN CORE ALONE CONFIGURATION

PSLV-C14/OCEANSAT-2 MISSION

PSLV-C14, the 16th flight of PSLV will inject Oceansat-2 and six nano-satellites into 724.7 km circular SSPO. Core Alone configuration of the vehicle with PS4 L2.5 stage is used to place the satellites in orbit.

MISSION SPECIFICATIONS

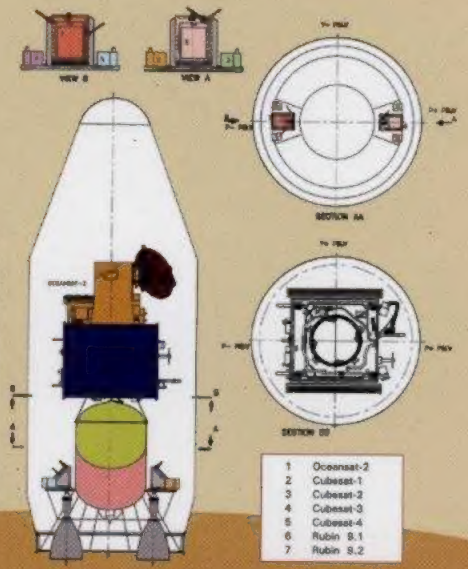
Orbit	: Sun Synchronous Polar Orbit (SSPO)
Altitude	: 724.7 ± 20 km
Inclination	: 98.28 ± 0.2 degree
Launch time	: 11.51 Hrs (IST)
Launch window	: -0/+15 min
Launch azimuth	: 140 degree

VEHICLE

Overall height	: 44.4 m
Lift-off mass	: 228 t
First stage	: PS1(S139), HTPB solid propellant
Second stage	: PS2(PL40), UH25+N_2O_4 liquid propellant
Third stage	: HPS3, HTPB solid propellant
Fourth stage	: PS4(L2.5), MMH+MON3 liquid propellant

Changes and New elements in C-14 Vehicle

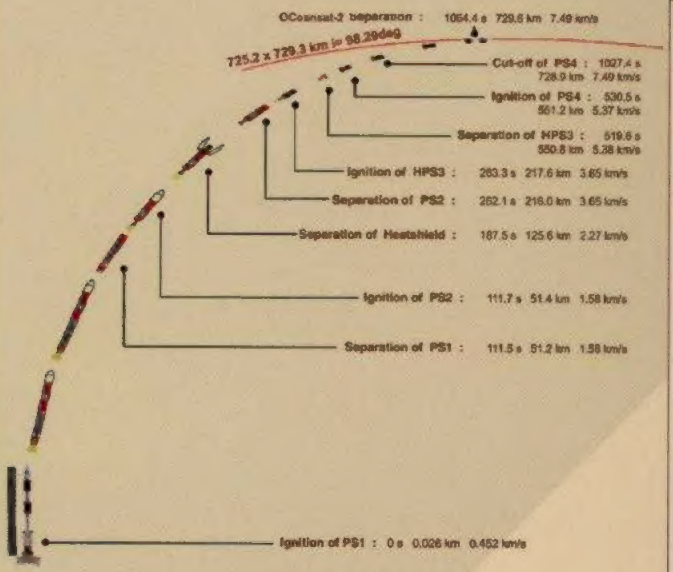
- PS4 to use L2.5 stage
- First time use of ECI frame and Quaternion based guidance computation for SSPO mission
- Introduction of 45° inclined auxiliary decks to mount Rubin-9.1& Rubin-9.2 nano-satellites on EB
- Cubesats are separated using a separation system, Single Picosatellite Launcher (SPL) supplied by the user
- 'O' ring seal configuration for PS1 motor pressure transducer joints



Spacecraft accommodation in C14

FLIGHT SEQUENCE

The flight sequence given below highlights the planned time, altitude and velocity at critical events. Some of the events are decided onboard and the actual time of occurrence can vary marginally.



PSLV-C14 flight profile

EVENTS	PSLV-C14 MISSION		
	Time(s)	Altitude (km)	Inertial Velocity (m/s)
RCT Ignition	-3.00	0.02619	451.89
PS1 Ignition	0.00	0.02619	451.89
PS1 Tail-off (RTD-T2)	106.52	46.23	1603.78
PS1 Separation	111.52	51.18	1581.97
PS2 Ignition	111.72	51.38	1580.96
Heat shield Separation	187.52	125.63	2273.14
C L G Initiation	192.52	130.94	2341.31
PS2 shut-off (RTD-T3)	259.14	211.80	3638.25
PS2 Separation	262.14	215.99	3652.05
PS3 Ignition	263.34	217.66	3647.87
PS3 burn out (RTD-T4)	385.58	382.59	5631.59
PS3 Séparation	519.58	550.86	5383.65
PS4 Ignition (RTD-T5)	530.52	561.22	5367.68
PS4 Cut-off (RTD T6)	1027.4	728.96	7485.10
OCEANSAT-2 Separation	1064.4	729.68	7490.47
CUBESAT-1 Separation	1104.4	730.42	7490.15
CUBESAT-3 Separation	1124.4	730.8	7489.98
CUBESAT-2 Separation	1164.4	731.58	7489.63
CUBESAT-4 Separation	1184.4	731.98	7489.46

Separation sequence of spacecrafts in PSLV-C14 mission

T6 + 37s
Oceansat-2 Separation

T6 + 77s
Cubesat-1 Separation

T6 + 97s
Cubesat-3 Separation

T6 + 137s
Cubesat-2 Separation

T6 + 157s
Cubesat-4 Separation

OCEANSAT-2

Oceansat-2 spacecraft weighing 956 kg will provide continuation of services of Oceansat-1 (IRS-P4 launched by PSLV-C2 on 26 May, 1999) with enhanced capabilities & increased application areas. The spacecraft, built by ISRO Satellite Centre, Bangalore will fly Ocean Colour Monitor (OCM), Ku-band Scatterometer and Radio Occultation Sounder for Atmosphere (ROSA). During operational phase of the spacecraft, Scatterometer and ROSA payloads are continuously ON and OCM will be switched ON during sun-lit passes over oceans as per user requirements.

The mission objectives of OCEANSAT-2 are the following:

- To design, develop, launch and operate state of-the art three axes stabilized spacecraft carrying the Ocean Colour Monitor, Ku-band Scatterometer and the dual frequency Radio Occultation Sounder for Atmospheric studies with a mission life of 5 years
- To develop algorithms for retrieval of parameters such as wind vector from Scatterometer; chlorophyll, suspended sediments, aerosol optical depth from Ocean Colour Monitor; characterise the lower atmosphere and the ionosphere using ROSA; and to supply data products operationally to the user community
- To promote newer applications in the areas of ocean and atmospheric science

OCM is a multi-spectral optical camera, that provides ocean colour data with repetivity of two days. It provides a ground IFOV of 360 m in across track and 246 m in along track directions covering a swath of 1420 km . Provision exists for onboard calibration of this payload.

The Ku band pencil beam scatterometer is an active microwave sensor that provides a ground resolution cell of size 50x 50 km for measurement of wind speed and direction. It has two modes of operation-raw data mode and processed data mode. Raw data mode will be used only during the initial phase for validation of processed data.

The ROSA is a GPS Receiver for atmospheric sounding by radio occultation. The GPS receiver determines position, velocity and time using GPS signals. It provides real-time navigation data with conventional accuracy. Additionally this payload derives the atmospheric parameters (Temperature, humidity and pressure) through RF signals from the 'rising' GPS satellites near Earth's horizon through its occultation antenna & from the excess phase delay and Doppler measurement. The ROSA instrument processes the received GPS signals in both the L1 (1575.42 MHz) and L2 (1227.6 MHz) frequency bands.

Physical Characteristics of OCEANSAT-2	
Mass	: 956 kg
Shape	: cuboidal
Overall dimensions in launch configuration	: 2445x1972x2900(h)
End to end length in deployed mode	: 11400 mm
Solar panel	: 2 wings of 3 panels each
Power	: 1140 watts EOL average

OCEANSAT-2 DEPLOYED CONFIGURATION

PASSENGER PAYLOADS

CUBESAT SATELLITES

The four CUBESATs are educational satellites from European universities, each weighing around one kg and developed to perform technology demonstration in space. The satellites are housed inside individual SPL weighing one kg.

CUBESAT-1 /UWE-2 (Universität Würzburg, Germany)

Mission objectives:

- Demonstration of a newly developed Attitude Determination and Control system (ADCS)
- Technology demonstration of a GPS on Cubesat

CUBESAT-1

CUBESAT-2 /BeeSat (Technische Universität Berlin, Germany)

Mission objectives:

- On-orbit verification of newly developed micro reaction wheels for picosatellite applications
- Demonstration of the use of coin sized micro reaction wheels for attitude control of picosatellites

CUBESAT-2

CUBESAT-3/ITU-pSAT1 (Istanbul Technical University, Turkey)

Mission objectives:

- To examine the performance of an on-board passive stability system using a magnet
- To download photographs taken using a camera with a resolution of 640X480 pixels

CUBESAT-3

CUBESAT-4/SwissCube (Ecole Polytechnique Fédéral de Lausanne, Switzerland)

Mission objectives:

- To take optical measurements and characterise the airglow intensity over selected latitudes and longitudes
- To demonstrate the measurement of airglow intensity using off-the shelf detector and its validation

CUBESAT-4

RUBIN-9

RUBIN-9 consists of two S/Cs Rubin 9.1 and Rubin 9.2 weighing 8 kg each and will primarily be used for the Automatic Identification System (AIS) for Maritime applications. These are non-separable payloads that are mounted at an angle of 45 deg to the PSLV EB deck.

Rubin9.1 is developed by Luxspace, Luxembourg and has a mission objective of providing an insight into the issue of message collisions that limit detection in areas of dense shipping.

Rubin-9.1

Rubin-9.2

The main purpose of the R9.2 spacecraft is to test and qualify nano technologies from Angstrom company, Sweden and to continue space based maritime Automatic Identification System (AIS) receiver experiments (started with Rubin-7 and Rubin-8 missions).

R9.2 is similar to the Rubin-8 launched on PSLV in April 2008.

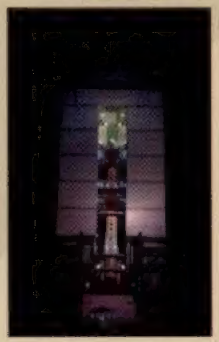
PRE LAUNCH OPERATIONS

CBS assembly

PS1 stage at MST

PS2 receipt at MST

PS3-PS4 Moduling



Vehicle ready to receive spacecrafts

Oceansat-2 testing

Nano satellites after testing

Satellites integrated to vehicle

HS closure

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